



## **Progress Report**

**For**

**Colorado Department of Agriculture**  
***Advancing Colorado's Renewable Energy:***  
**Oilseed Cropping as a Strategy for Sustained Farming in a**  
**Region Impacted by Agricultural Water Transfers**

to

Tom Lipetzky, Markets Division Director  
Colorado Department of Agriculture  
700 Kipling Street, Suite 4000  
Lakewood, CO 80215-8000

***October 30, 2010***

***CONTACT:***

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## **Project Overview**

Southeast Colorado RC&D was awarded \$27,500 to research lower water consumptive use oilseed crops (soybean, canola, sunflower, camelina) as alternatives to currently grown high water consumptive use crops (corn, alfalfa) in the Lower Arkansas Valley. This research is an important step for maintaining and encouraging agriculture in an area impacted heavily by prior water rights sales, and likely to be affected by water leasing in the future.

The purpose of this research is to evaluate the agronomic and economic performance of oilseed crops under water availability conditions likely to arise as water leasing arrangements are undertaken in the Lower Arkansas Valley. The essential objectives of this research project are to:

- 1) Compare yields and oil production for four oilseed crops (soybean, canola, sunflower, camelina) under dryland or winter farming conditions that will complement water lease arrangements;
- 2) Evaluate oil and biodiesel performance through engines testing needed to establish the value of one or more of these crops, and;
- 3) Conduct feedstuff analyses on the animal meal byproduct of the refining process for each crop.

## **Work Completed to Date - 10/30/10**

Funds were awarded in March 2010. Dr. Perry E. Cabot, CSU Extension Water Resources Specialist, is the CSU coordinator for the project. Jim Valliant, CSU Extension Specialist, is doing field observation. Jim has met with growers and the processor, Big Squeeze LLC, on a regular basis. Growers have also traveled to CSU's Engines and Energy Conversion Lab.

### **Cropping**

Four varieties of canola (Hyclax 115W, 154W, Sanfran, and Sitro) were planted on the Joel Lunquist farm August 25 & 26, 2010. The varieties were planted in 5 acre plots, on dry ground, and irrigated up by furrow irrigation. These canola varieties have been irrigated twice since then.

Some of these same varieties of canola were also planted on the Rick Young farm and Hal Holder farm. All crops are up to stand, and all have been irrigated and prepared for winter.

14 different varieties of camelina were planted the first week of October 2010 for variety testing. With the unusually warm fall weather this first planting has already germinated, has just emerged, and looks good. It has been furrow irrigated once. (See cropping photos in Exhibit A.)

The CSU Arkansas Valley Research Center is also doing irrigation trials (limited vs. optimum), variety trials, and cultural studies, all of which will compliment this ACRE grant research and benefit local producers.

### **Testing**

Sunflower oilseed planted in 2009, and harvested in 2010, was crushed into SVO and tested by CSU's Engines & Energy Conversion Lab in April 2010. CSU Extension's primary research completed includes the first of several engines tests for the fuel blends summarized in Table 1

(below) using sunflower oil as the straight vegetable oil (SVO) basis. The fuels evaluation was performed on a 4.5L John Deere engine at the CSU Engines and Energy Conversion Laboratory. The maximum torque and horsepower data appears to fall relatively close to that of the previous SVO and biodiesel work performed by CSU, showing a slight decrease for the blended fuels. This is due to the lower energy content of the SVO base (37000 kJ/kg vs. 42,500 kJ/kg for diesel). The emissions appear to follow the same trends seen with other biofuels. It shows a slight increase in NO<sub>x</sub> emissions with generally reduced hydrocarbon and carbon monoxide emissions.

**Table 1. Blended fuels summary chart for fuels tested April 26, 2010.**

<i>Parameter</i>	<b>BLEND "A"</b>	<b>BLEND "B"</b>	<b>BLEND "C"</b>
straight vegetable oil (SVO)	17.00 gallons	9.00 gallons	6.00 gallons
specific gravity (SG) @ 58°F	0.890	0.890	0.890
NOTE: <i>sunflower oil</i>			
regular unleaded gasoline (RUG)	7.83 gallons	4.20 gallons	2.72 gallons
SVO + RUG	24.83 gallons	13.20 gallons	8.72 gallons
fraction RUG/(RUG + SVO)	0.315	0.318	0.312
specific gravity (SG) @ 58°F - for total blend	0.869	0.870	0.870
diesel fuel (DF)	0 gallons	13.20 gallons	17.38 gallons
		50/50 blend	66.6/33.3 blend
TOTAL (SVO, RUG, and DF)	24.83 gallons	26.40 gallons	26.10 gallons
SVO/Blend Ratio	68%	34%	23%

\* data provided by Hal Holder on February 15, 2010

Other work completed included a cold soak filterability and glycerin analysis on Blend A (see Table 1 above and the attached certificate from Microbac Labs in Exhibit B). The results for the Free and Total Glycerin, Cold soak, KF water and Total Acid Number do not meet the requirements of ASTM D6751 for B100 Biodiesel. This is not surprising because the Big Squeeze blends are not intended to produce biodiesel.

### **Problems being encountered and/or mitigating circumstances - 10/30/10**

#### **Cropping**

One challenge encountered was the limited supply of winter camelina seed available in Colorado. A seed source was eventually located through Colorado State University (Prof. Jerry

Johnson), but not in large enough quantity for SVO production. Winter camelina is a relatively new crop to southern Colorado, so it is currently being evaluated (through this grant) at the CSU Arkansas Valley Research Center. Pending the results of our variety trials, we will plant greater acreage next year and conducted associated fuels testing.

### **Testing**

The blended fuels experienced a “boiling” in the return system that formed vapor bubbles that impacted the accuracy of the fuel consumption measurement. The return flow meter used by the CSU Engines and Energy Conversion Lab was strictly a volume flow meter and the change of state of the working fluid invalidated the measurement. This problem has since been resolved, and the next round of fuels testing will be conducted to include a fuel consumption and mileage measurement.

### **Processing**

Big Squeeze LLC began having issues with their high speed, self cleaning centrifuge. The US distributor (US Centrifuge, Cincinnati, OH) for the Italian manufactured piece of equipment was unable to resolve the problem, and then sold out to another company who refused to warranty the centrifuge. September 18-21, 2010, Big Squeeze had the Italian technician from the manufacturer (Servizi Industriali) in Rocky Ford to repair the centrifuge. The centrifuge has been working flawlessly since the repair.

In early September Big Squeeze LLC requested \$2000 be allocated from this ACRE grant, to help pay for the Italian technician’s travel. The project partners had received an unexpected \$2000 discount on the testing performed by CSU’s Engines Lab, consequently Perry Cabot with CSU was also in agreement with the reallocation. RC&D requested, and CDA approved the reallocate of \$2000 of the \$4000 budgeted for “Oil Seed and Soil Sampling Analysis” to Travel.

## **Work Plan**

### **Cropping**

14 different varieties of camelina will be planted for variety testing in the spring (2011).

The Valley’s irrigation canals go into the Winter Water Storage Program period from November 15 to March 15, so irrigation will not occur during these months.

### **Testing**

The next round of fuels testing will be conducted in November 2010 on SVO (canola basis). We will also plan on conducting at least one more fuels test during the course of this project in 2011.

(See Project Timeline on next page.)

## Project Timeline

Work began in March 2010, and will conclude by March 1, 2012, per the original timeline seen below.

Table 1. Project Timeline for ACRE Research Project (Rocky Ford, CO)		YEAR 1		YEAR 2	
OBJECTIVES and TASKS		3/10	2/11	3/11	2/12
<b>OBJ. 1: Oilseed cropping under reduced water availability</b>					
Soybean (4 acres; 3 replicates)	Planting				
Sunflower (4 acres; 3 replicates)	Planting				
Winter Canola and possibly camelina (4 acres; 3 replicates)	Planting				
Spring Camelina (4 acres; 3 replicates)	Planting				
Annual soil sampling					
Spring Crop (soybean, sunflower, camelina)	Harvest				
Winter Crop (canola, camellia – possibly)	Harvest				
<b>OBJ. 2: Oilseed processing and engine performance evaluation</b>					
Oilseed crushing, pressing, centrifuge (Big Squeeze, LLC)					
Engine Testing of Spring Oilseed Crops (CSU Engines Lab)					
Engine Testing of Winter Oilseed Crops (CSU Engines Lab)					
<b>OBJ. 3: Feedstuff analysis of refinery byproduct</b>					
Animal meal samples separated					
Send to approved feedstuff testing laboratory					
Analysis received					
<b>OTHER TASKS</b>					
Demonstration field days (with CSU Extension Personnel)					
Applicable publication(s) for CSU Extension delivery					
Reporting requirements for ACRE Grant					

(See Project Budget on next page.)

## Project Budget

### ADVANCING COLORADO'S RENEWABLE ENERGY (ACRE) PROGRAM

Claim for Reimbursement  
FY10 Program

**Contractor Submitting Claim:** Southeast Colorado RC&D, Inc. (a 501(c)(3) organization)  
(name and mailing address) Jim Valliant, Chairman of SE Colo RC&D, Inc.  
3505 S Main St  
Lamar, CO 81052

**Amount of Claim (\$):** \$27,500

#### Claim Summary

ACRE Funding		Contractor Match	
Approved Contract Amount	\$27,500	Total Match Required	\$15,442
Amount Previously Claimed	2,374	Match Previously Reported	994
<b>Amount Requested This Claim</b>	<b>580</b>	Match Reported This Claim	245
Total Amount Claimed to Date (including this claim)	2,954	Total Match Reported to Date (including this claim)	1,239
Contract Funds Remaining	24,546	Match Requirement Remaining	14,448

Please attach supporting documentation and evidence of payment relating to all amounts claimed.

Certification: I certify that, to the best of my knowledge, the information and amounts stated in this claim are complete, true, and accurate, that the expenditures claimed on this form were in fact incurred by the Contractor for the purpose authorized and that the expenses claimed were necessary and reasonable for the purpose and verifiable and supported by detailed records which are available for inspection.

Name\*: Gary L. Anderson Title: CPA, accountant for S.E. Colo RC&D, Inc.

Signature  Date: 8/31/10

Telephone: 719-336-7785

FAX: 719-336-7786

E-mail: garyandersoncpa@bresnan.net

\*Please list the name of the person to contact with regard to this claim for reimbursement.

#### For Office Use Only:

Fund: \_\_\_\_\_ Agency Code: \_\_\_\_\_ Appropriation Code: \_\_\_\_\_

Organization Unit: \_\_\_\_\_ Object Code: \_\_\_\_\_ Contract #: \_\_\_\_\_

## Exhibit A



Planter



Canola Stands



Camelina

# Exhibit B



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## Microbac Laboratories, Inc.

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### CERTIFICATE OF ANALYSIS

Colorado State University  
Perry Cabot  
2200 Bonforte Blvd.  
417 Chemistry Bldg, CSU-Pueblo  
Pueblo, CO 81001

Date Reported 06/30/10  
Date Received 06/16/10  
Order Number 1006-00221  
Invoice No. 15169  
Cust # C195  
Customer P.O. Perry Cabot (CC)

Sample	Analysis	Method	Test Result	Units	Minimum Reporting Limit	Actual Result	Date	Tech
001	<b>CSU-Pueblo</b>							
	Karl Fischer	HL 3530	744	ppm	0.1	744	06/21/10	ERB
	ASTM D56 Tag Closed Cup Flash Point	ASTM D56	25.5	degrees C		25.5	06/25/10	ERB
	ASTM D2500 Cloud Point	ASTM D2500	-8	Celsius		-8	06/25/10	JLF
	Cold Soak Filterability	ASTM D6751.08 Ann	>12	Minutes		>12	06/23/10	ERB
	Free and Total Glycerin	ASTM D6584					06/22/10	CMS
	Total Glycerin	ASTM D6584	6.73	%	0.05	6.73	06/22/10	CMS
	Free Glycerin	ASTM D6584	<0.05	%	0.05	<0.05	06/22/10	CMS
	Monoglyceride	ASTM D6584	<0.01	%		<0.01	06/22/10	CMS
	Diglyceride	ASTM D6584	0.87	%		0.87	06/22/10	CMS
	Triglyceride	ASTM D6584	63.11	%		63.11	06/22/10	CMS
	ASTM D664 Acid Number	ASTM D664	1.56	mg KOH/g		1.56	06/21/10	CMS
	Corrosion	ASTM D130	1A			1A	06/25/10	JLF

**Results for the Free and Total Glycerin, Cold soak, KF water and Total Acid Number DO NOT meet the requirements of ASTM D6751 for B100 Biodiesel.**

#### Flags, footnotes and abbreviations (as needed)

\*OST = Outside Subcontracted Testing (For more details, please contact the Project Manager)  
NA = Not Analyzed  
N/A = Not Applicable  
CFU = Colony Forming Units  
IU = International Units  
g/100g = Grams per 100g of sample  
mg/L = Milligrams per Liter (ppm)  
mg/kg = Milligrams per Kilogram (ppm)  
ug/L = Micrograms per Liter (ppb)  
ug/kg = Micrograms per Kilogram (ppb)

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Chemical, Microbiological, and Mechanical Analyses and Research

MEMBER



## Exhibit B continued



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### Microbac Laboratories, Inc.

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417 Chemistry Bldg, CSU-Pueblo  
Pueblo, CO 81001

Date Reported 06/30/10  
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Order Number 1006-00221  
Invoice No. 15169  
Cust # C195  
Customer P.O. Perry Cabot (CC)

Sample	Analysis	Method	Test Result	Units	Minimum Reporting Limit	Actual Result	Date	Tech
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**Report Authorized by Steve Ferry (Managing Director: Hauser Division)**

**Technical review performed by Project Manager (signature on file)**

For any feedback concerning our services, please contact the Managing Director or James Nokes, President at [james.nokes@microbac.com](mailto:james.nokes@microbac.com) or Robert Morgan, Chief Operating Officer, at [robert.morgan@microbac.com](mailto:robert.morgan@microbac.com)

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